cymes in many of the leaf axils, the aggregate inflorescence not distinctly paniculate; middle cauline leaves 2–5 cm. long; corolla 10–15 mm. long, outside puberulent and on and below the lobes, also hispidulous; calyx at anthesis 5–7 mm. long; Tibet.....19. *O. Waddellii.*

Anthers more than half exserted, commonly almost completely so.

Base of filaments and adjacent corolla-tube villose.

Leaves obviously broadest at or above middle, gradually attenuate towards the very narrow acute or even subpetiolate base; plant with very slender loosely branching stems; China.....11. *O. sinicum.*

Leaves broadest at or near base.

Plant robust, flowering stems coarse, 3–5 mm. thick; filaments subulate, broadest at the very base; Burma....12. *O. burmanicum.*

Plant with clusters of slender erect simple flowering stems 2 mm. or less thick; filaments broadest (0.5–0.7 mm.) a short distance (0.5–1 mm.) above base, hence perceptibly narrowed just above the attachment; n. w. Himalaya....13. *O. hypoleucum.*

Base of filament and adjacent corolla-tube not villose.

Stems coarse, usually 5–12 mm. thick near base, rising singly from a stout biennial root, more than 6 dm. tall, usually reaching a meter or more; China.

Anthers becoming completely exserted; corolla-throat 4.5–5 mm. thick, inside hairy below the lobes; calyx and pedicels strigose with stout short hairs less than 1 mm. long; anthers 5.5–6.5 mm. long; sterile tip 0.5–1 mm. long.....14. *O. exsertum.*

Anthers only half exserted; corolla-throat 8–10 mm. thick, glabrous inside; calyx and pedicels villose-hispid, the hairs mostly spreading and 1–3 mm. long; anthers 7–8 mm. long, sterile tip 1.5–2 mm. long.....15. *O. fistulosum.*

Stems more slender and shorter, usually several rising together from the root.

Tip of anthers and tip of flower-bud becoming curved to one side; China.....16. *O. multiramosum.*

Tip of anthers and tip of flower-bud straight or nearly so.

Base of filament and adjacent portions of corolla-tube papillate and glanduliferous; base of filament not decurrent. China.....17. *O. adenopus.*

Base of filament and adjacent corolla neither papillate nor glanduliferous (decurrent base of filament sometimes papillate in no. 19).

Style hairy below middle; corolla-throat abundantly hairy inside; anthers 9–10.5 mm. long, sterile tip 2.5–3 mm. long.....18. *O. album.*

Style glabrous; corolla-throat glabrous or with only inconspicuous lines of hairs below the lobes; anthers 4–8.5 mm. long, sterile tip 0.3–2 mm. long.

Filaments with a prolonged elevated decurrent base 2.5–3 mm. long; corolla-throat 5–8 mm. broad, inside frequently bearing a line of hairs below each lobe; plant not developing a shrubby caudex; Tibet.....19. *O. Waddellii.*

Filaments not decurrent, with transverse arcuate attachment; corolla-throat narrow, 3–5 mm. thick, glabrous inside; base of stems persisting and forming a loose fruticulose caudex.

Middle cauline leaves oblanceolate; corolla blue, outer surface with antrorse hairs; China.....20. *O. Farrerii.*

Middle cauline leaves lanceolate; corolla white, outer surface with mostly retrorse hairs; n. w. Himalayas.....21. *O. Thomsoni.*

Anthers united only at the very base.

Calyx divided into narrow, very elongate, linear or linear-lanceolate lobes; lobes many times longer than broad.

Corolla shorter than calyx-lobes or at most equaling them; bracts lanceolate, with excessively prolonged tips; lower leaf-face evidently veined, clothed with a pallid indument of abundant minute hairs; western Himalaya (Kumaon).....22. *O. bracteatum.*

Corolla evidently surpassing the calyx-lobes; bracts lanceolate or subulate, tips acute.

Filaments attached at or above middle of corolla; corolla 16–33 mm. long.

Corolla blue or red, outer surface with abundant evident appressed hairs; nectary villose; anthers 5.5–9 mm. long, sterile tip ca. 0.5 mm. long; plant 1–3 dm. tall, perennial; eastern Himalaya and Tibet.....23. *O. Hookeri.*

Corolla yellow, outer surface glabrous or nearly so; nectary glabrous; anthers 9–12 mm. long, sterile tip 1–1.5 mm. long; plant 2.5–10 dm. tall, biennial; Afghanistan, Baluchistan and adjacent India.....24. *O. dichroanthum.*

Filaments attached distinctly below the middle of the corolla.

Filaments thickened and conspicuously villose just above the base, 5–6 mm. long, attached 1.7–2.5 mm. above corolla-base; corolla barrel-shaped, red, broadest near middle, 11–13 mm. long; anthers 4–4.5 mm. long; Kumaon.....25. *O. pyramidale.*

Filaments not thickened nor hairy above the base; corolla gradually expanding from the base, broadest at or near the level of the lobes, pink to purple.

Corolla twice as long as the calyx-lobes, 16–17 mm. long; filaments 4–5 mm. long, attached 5–6 mm. above base of corolla; anthers 7–7.5 mm. long; western China.....26. *O. mertensioides.*

Corolla about once and a half the length of calyx-lobes, 7–17 mm. long.

Plant 1–3 dm. tall; stems simple or producing a few coarse cymes in the upper axils; corolla minutely hispidulous or villulose or nearly glabrous outside; nectary sparingly hairy or nearly glabrous; filaments 1.5–6.5 mm. long, attached 3–8 mm. above corolla-base; anthers 2.5–6.5 mm. long; Afghanistan, Baluchistan and adjacent India.....27. *O. limitaneum.*

Plant 5–15 dm. tall; stems with very numerous floriferous branches; corolla evidently and abundantly appressed villose outside; nectary densely villose; s. w. China.

Stems very bristly, tawny hispid; style and decurrent base of filaments glabrous; filaments 2–2.5 mm. long, attached 2–2.5 mm. above corolla-base; anthers 4–4.5 mm. long.. .....28. *O. cingulatum.*

Stems sparingly bristly, cinereous; style below middle and decurrent base of filaments sparingly hairy; filaments 4 mm. long, attached 3.5 mm. above corolla-base; anthers 5.5 mm. long.....29. *O. Tsiangii.*

Calyx with a broad shallow tube and cuneate or narrowly triagular lobes; lobes gradually narrowed from the broad base, 1.5–3 times longer than broad.

Corolla 14–18 mm. long.

Corolla above middle minutely verruculose; Nepal..... .....30. *O. verruculosum.*

Corolla not verruculose, firmer; Assam and s. w. China.

Leaves mostly with stiffish appressed hairs 1–2 mm. long; plant drying light in color.....31. *O. Borii.*

Leaves with more slender spreading hairs 2–3 mm. long; plant noticeably darkening in drying.

Cauline leaves with obtuse or acute base, moderately hairy..... .....32. *O. lycopsioides.*

Cauline leaves abruptly rounded at very base, abundantly hairy.. .....33. *O. microstoma.*

Corolla 9–12 mm. long.

Filaments 5 mm. long; corolla yellow; Yunnan..34. *O. dumetorum.*

Filaments 1–2.5 mm. long; corolla blue or purple.

Root stout, strong, perennial, 5–15 mm. thick.....35. *O. emodi.*

Root weak, slender, annual or at most biennial, 0.5–2 mm. thick.

Corolla 1–1.5 times longer than broad, broadly ovoid, with puffed-out ribs conspicuously protruding between the calyx-lobes.. .....36. *O. Wallichianum.*

Corolla twice longer than broad, barrel-shaped, ribs weakly protruding between the calyx-lobes.

Hairs of foliage single, none stellately arranged..... .....37. *O. bicolor.*

Hairs stellately arranged on leaf, at least on the upper surface.. .....38. *O. egregium.*

1. **Onosma paniculatum** Bureau & Franchet, Jour. de Bot. **5**: 104 (1891); Handel-Mazzetti, Symb. Sinicae 7²: 816 (1936). — Type from the vicinity of Tatsienlu, *Bouvalot & d'Orleans.*

Onosma paniculatum var. *hirsutistylum* Lingelsh. & Borza, Repert. Sp. Nov. **13**: 389 (1914). — Type from mountain slope between Yo-tsai and Kwang-dung on road from Yunnan to Tsuyung, *Limpricht 966.*

Plant biennial or rarely perennial, darkening in drying, with a stout dye-stained taproot; stems single, 3–12 dm. tall, 5–10 mm. thick towards the base, sparingly hispid (hairs spreading, 1–4 mm. long, bulbose-based) and abundantly and usually retrorsely hispidulous or villulose (hairs 0.1–0.5 mm. long), producing pedunculate cymes from the upper axils but otherwise unbranched; leaves appressed hispid (hairs 2–4 mm. long,

arising from discoid bases) and sparingly villulose or hispidulose on the upper surface, lower surface abundantly hispidulous or villulous and sparingly and inconspicuously hispid; lower leaves 10–20 cm. long, 1–3 cm. broad, oblanceolate with a winged petiole; cauline leaves gradually reduced up the stem, lanceolate, 1–2 cm. broad, those above the middle sessile, broadening above the base and becoming somewhat sagittate and even somewhat amplexicaul; cymes mostly simple, very numerous, terminal on the main stem and arising on leafless peduncles 3–10 cm. long from many of its upper axils, hence paniculately displayed, at anthesis 2–4 mm. broad, in fruit elongating and unilaterally racemose, 5–10 cm. long; larger bracts more or less sagittate, smaller bracts lanceolate or subulate; calyx hispid and strigulose, 5–14 mm. long, not much accrescent in fruit; pedicels slender, straight, 5–20 mm. long; corolla red or pinkish red changing to violet and blue, 12–17 mm. long, from a base 2.5–3.5 mm. thick gradually expanding upwards, 8–10 mm. thick at level of sinus, outside abundantly antrorse-strigulose, inside strigulose on throat below each corolla-lobe; lobes broader than long, margin revolute; anthers included or with only tips exserted, coherent basally and laterally to form a tube, 6–8 mm. long, base borne 6–8 mm. below level of corolla-sinus, filament-attachment 1–1.7 mm. above base; filaments 3–4.5 mm. long, evidently villulose, from a decurrent base 1 mm. long and 0.4–0.8 mm. wide gradually narrowed upwardly, arising 3–4.5 mm. above corolla base; nectary about 0.5 mm. high, lobed, densely villose; style 15–18 mm. long, lower two-thirds appressed hairy; nutlets 2 mm. long, dull, verrucose.

Southwestern China, from central Sikang south in the highlands to Yunnan and adjacent Kweichow; also in Bhutan.

SIKANG: betw. Yenyuan and Hunka, 2800 m., *Schneider 1481* (E); Huei-li Hsein, grassy place on mountain slope, 2800 m., plant 3 ft. tall, fl. pinkish red, *T. T. Yü 1525* (G); near Tatsienlu, *Bouvalot & d'Orleans* (G, frag. of type).

YUNNAN: Mengtze, 6500–7000 ft., fl. red with bluish tinge, *Henry 9334A* (NY, Ed); east base of Tali Range, open stony pasture land, plant 2–4 ft. tall, fl. deep rose-purple, 6700–8000 ft., *Forrest 4472* (Ed); in monte Lautsching in dist. Yunnan-fu, in rupibus calcar., fl. rubescentibus, alt. 2200 m., *O. Schoch 225* (US); Ahsi, northwest Likiang Snow Range, open hillsides, pl. 3 ft., fl. rose-purple and rose-blue, *R. C. Ching 20781A* (G); Likiang, 2950–3100 m., fl. red becoming blue, *Handel-Mazzetti 4164* (G); Likiang plain, lat. 27°20′, plant 2–4 ft., fl. rose changing to blue, dry open situations, 8500 ft., *Forrest 6085* (Ed); east flank of Likiang Range, lat. 27°12′, dry stony open situations in pine forest, 9000–10500 ft., plant 1.5–2.5 ft. tall, fl. at first rose-purple then blue, *Forrest 2447* (Ed); Chin Hai Tze, east slope Likiang Snow Range, alpine meadow, 11000 ft., fl. red and blue, *Rock 4441* (G, US, Ed); Tungchwan, fl. pink becoming blue, 2600 m., *Maire* (G, US, Ed); north flank Haba Snow Range, dry open pine forest, plant 2–3 ft. tall, fl. flushed purple and blue-purple, *K. M. Feng 1319* (G); inter Lanticho et Poloti, reg. Yungning-Yingpeh, fl. obscure purp., June 29, 1914, *Schneider 1682* (US).

KWEICHOW: Weining, open hillside, fl. red, *Y. Tsiang 9108* (NY).

BHUTAN: Lingtsi to Kurmed, sandy soil under *Pinus longifolia*, 6000 ft., fl. red and blue, July 24, 1915, *R. E. Cooper 4176* (Ed); Re-Teng to Tsaza-La, 8175–9125 ft., July 2, 1938, *B. J. Gould 742* (K, DD).

TIBET: upper Chumbi Valley, 12000 ft., Sept. 1938, *B. J. Gould 1577* (K).

This is the most widely distributed and the most frequently collected of the Chinese species of the genus. It is very distinct, readily recognizable and has its closest relative in *O. oblongifolium*. In producing a single tall flowering stem from a stout biennial root, it has a growth habit shared by several other species in southwestern China, namely *O. oblongifolium*, *O. album*, *O. exsertum*, and *O. fistulosum*. *Onosma confertum* has a somewhat similar appearance but its root can be persistent and may produce more than a single stem each season. A very unusual feature of our plant is its sagittate uppermost leaves. These are a very useful aid in recognizing it.

2. **Onosma oblongifolium** W. W. Smith & Jeff. Notes R. Bot. Gard. Edinburgh 9: 113 (1916). — Type from bend of Yangtse, lat. 27° 45′, Yunnan, *Forrest 11198*.

Plant biennial, producing a single erect stem 7.5 dm. tall; stem 7 mm. thick towards base, above middle producing leafless floriferous branchlets 5–15 cm. long, abundantly hispidulous, the minute hairs retrorse 0.5–1 mm. long mostly with a thickened base; leaves green, scabrous, ample, gradually reduced up the stem, minutely hispidulous, on upper surface also with scattered short bristles arising from discoid bases; basal leaves unknown; middle cauline leaves sessile, narrowly oblong, 12–14 cm. long, 30–38 mm. broad, broadest at or just above the middle, base abruptly contracted, obtuse, apex obtusish; upper cauline leaves oblong-lanceolate to triangular-ovate, broadest just above the truncate or abruptly rounded and subamplexicaul base; cymes numerous, terminal and on peduncles arising from many of the uppermost axils, hence paniculately displayed, in fruit unilaterally racemose, 5–7 cm. long; bracts ovate to acute, broadly attached; calyx 10–12 mm. long, not much accrescent in fruit; hispidulous and sparingly bristly below middle; pedicels slender, 5–13 mm. long; corolla "bluish rose," 13–15 mm. long, from a base 2.5 mm. thick gradually expanded, becoming 8.5 mm. thick just below the sinus, outside above middle abundantly and antrorsely appressed villulose, throat inside strigose along a line below each corolla-lobe, lobes broader than long, margin revolute; anthers 7–8 mm. long, coherent basally and laterally to form a tube, base borne 6–8 mm. below level of corolla-sinus, attached to filament 1.5 mm. above base; filaments abundantly short villulose, from a decurrent base 1 mm. long and 0.5 mm. broad gradually narrowed upward, 4.5–5 mm. long, arising 2.5–3 mm. above corolla-base; nectary narrow, lobed, less than 0.5 mm. broad, villose; style 15–16 mm. long, appressed hairy; nutlets brown, opaque, 2.5–3 mm. long tuberculate obscurely pitted.

CHINA (northern Yunnan): mountains in the north of the Yangtse bend, 10000 ft., lat. 27°45′, open stony pasture, plant 2–2.5 ft. tall, fl. bluish rose, *Forrest 11198* (TYPE, Ed).

A very well marked species evidently related to *O. paniculatum*. Especially distinctive of the species are its broad leaves and its scanty indument in which the coarser components are reduced in size and comparatively sparse and inconspicuous. Compared with *O. paniculatum* the plant appears more luxuriant, glabrescent, and greener.

3. **Onosma chitralicum**, sp. nov.

Planta hispidissima (pilis patentibus 1–2 mm. longis) et abundanter minuteque hispidula (pilulis 0.1–0.2 mm. longis); caulibus infra medium ignotis, ad 4 mm. crassis, simplicibus vel solum apicem versus ramulo axillari 5–10 mm. longo sparse foliato floriferi donatis; foliis caulinis medionalibus lanceolatis crassiusculis acutis 2.5–4.5 mm. longis 3–8 mm. latis; cymis furcatis maturitate laxe racemosis 10–13 cm. longis; calyce sub anthesi 8–10 mm. longo 3–5 mm. longe graciliterque pedicellato lobis anguste lanceolatis 1–1.5 mm. latis villoso-hispidis; calyce fructifero 10–12 mm. longo ad 8 mm. longe pedicellato, lobis ad 2 mm. latis rigidis; corolla 12–14 mm. longa a basi ad 2.5 mm. crassa sursum gradatim ampliata apicem versus 4–4.5 mm. crassa, extus subglabra vel minutissime puberulenta, intus glaberrima, in sicco brunnea; antheris 6.5–7 mm. longis, basaliter lateraliterque cohaerentibus, tubum formantibus, 2–2.5 mm. supra basim affixis, basibus 6–7 mm. infra sinus corollae positis; filamentis linearibus, 2–2.5 mm. longis, 5–6 mm. supra basim corollae affixis; nectario glabro 0.2–0.3 mm. alto; stylo ca. 15 mm. longo; nuculis nitidis laevibus 3–4 mm. longis.

INDIA (Northwest Frontier): Chitral, *S. M. Toppin 481* (TYPE, Kew); Lowari Range, Chitral, 11000 ft., Aug. 1895, *Gatacre 17345* (DD).

A very distinct and well marked species for which I can suggest no very close relative.

4. **Onosma hispidum** Wallich, Numerical List 26, sub no. 938 (1829), nomen; D. Don, Gen. Syst. 4: 317 (1838). — "native of Kamaon" *Wallich 938*.

Onosma echioides sensu Clarke, Fl. Brit. India 4: 178 (1883); Blatter, Beautiful Flowers Kashmir 2: 60, t. 45, f. 3 (1928).

Plant perennial, bristly with spreading usually somewhat tawny hairs 2–5 mm. long, also minutely hispidulous; stems one to many, erect or ascending, simple or rarely branched, 1–5 or rarely 7.5 dm. long, 3–6 mm. thick towards base; leaves usually veinless, hispid and hispidulous on upper surface, the coarse hairs usually with discoid bases; basal leaves usually persisting at flowering time, oblance-linear to narrowly oblanceolate, 10–40 cm. long, 5–15 mm. broad, apex obtusish; middle cauline leaves linear-oblong or lance-oblong, obtusish, 4–8 cm. long, 4–10 mm. broad; cyme terminal, forked, at anthesis dense, 3–4 cm. broad, at maturity elongating, racemose, up to 15 cm. long; bracts lanceolate; calyx 12–15 mm. long at anthesis on pedicels 1–3 mm. long, lobes lance-linear, 1–2 mm. broad, tawny bristly, at maturity 15–25 mm. long on pedicels 5–10 mm. long, with lobes 1.5–3 mm. broad; corolla white, cream or pale yellow, 18–23

mm. long, from a base 3–3.5 mm. thick gradually expanding, 8–11 mm. thick just below the sinus, outside commonly sparsely hispidulous on the lobes and elsewhere very minutely puberulent, inside completely glabrous; anthers united basally and laterally to form a tube, 9–11 mm. long, attached ca. 2.5 mm. above base, tip to 2 mm. long, base held 8–11 mm. below level of corolla-sinus; filaments 5–6 mm. long, ligulate, arising 8–10 mm. above corolla base, decurrent base ad 5 mm. long; nectary a completely glabrous flange about 0.3 mm. high; style 13–23 mm. long, glabrous; nutlets 6 mm. long, smooth or obscurely roughened, somewhat lustrous.

Mountains of northwestern India, from Chitral to Kumaon.

INDIA: Seerenagur, *Kamroop in herb. Wallich* (K); above Jangla, Tehri-Garhwal, July 7, 1883,—no. *347A* (DD); Saugla, Baspa Valley, Simla Hills State, 12000 ft., fl. pale yellow, *Ludlow & Sherriff 7372* (G); Rogi Cliffs, Bashahr, 9000 ft., fl. greenish white, *Laurie 5403* (Ed, DD); Rogi in Kunawar, *Nanale* (DD); Rogee, *herb. Royle* (DD); Rong Gael, Tidong Valley, Bashahr, hot shale slopes 9500 ft., *R. M. Gorrie* (DD); Kauacharanga, Bashahr, 10000 ft.,—no. *62* (DD); Kunawar, 1885, *Drummond 22228* (UC, Ed); Chini Cliffs, Upper Kanawar, 9200 ft., *J. H. Lace 282* (Ed); Jashrang Cliffs, Bashahr, 9800 ft., fl. creamy white, *Parker 2914* (G, DD); Pricker, Lahul, 12000 ft., fl. yellow, *Bor 14852* (Ed, DD); Ganlur, Lahul, dry slopes, 10200 ft., dry slopes, fl. yellow, *Bor 15284* (Ed, DD); Dartse to Patseo, Bhaga, Lahul, *Schlagintweit 4092* (G); Dartse to Tsanskar Sumdo, *Schlagintweit 4132* (G); Lulu to Lahaul, 1888, *Drummond 22919* (UC, Ed); Kolong, Chenab Valley, Bashahr, 11000 ft., *T. R. Chand 115* (US); Pangi, Vhatwani Forest, Chamba, 9000 ft., *Harsukh* (UC); Pangim Chanba, Aug. 1880,—no. *280* (DD); Luj Forest, Chamba, 10000 ft., *Harsukh* (DD); Luj Forest to Pangi, 1897, *Lace* (Ed); Kagan Valley, Hazara, 8000 ft., *Inayat 19480* and *19481* (DD); Dis Valley, Chitral, 6000 ft., May 1895, *Gatacre 17344* (DD); Madajlast, Chitral, 10000 ft., July 1908, *Toppin 509* (K); Sai, 8000 ft., 1880, *Tanner 6* (DD); Ribe, 9000 ft., Sept. 1864, *Brandis 4137* (DD).

KASHMIR: below Traghol, 7–8000 ft., *R. R. Stewart 19438* (G); Tannin to Zojbal, 11000 ft., *J. R. Drummond 14202* (Ed); Machel, Sapphire Mines, Kishtawar, 9000 ft., open bracken-covered hillslope, fl. cream, *Ludlow & Sherriff 9124* (G); Matayan, Dras, 11000 ft., July 31, 1891, *G. A. Gammie* (DD); Chatpani nullah, west of Dras, 10–12000 ft., Aug. 27–28, 1893, *Duthie s. n.* and *13814* (DD); Joginai spur, opposite Jaodon Valley in Tilail, Kishanganga Valley, 12000 ft., 1909, *Kesharanand 1440* (DD); near Gagangir, Sind Valley, 7800 ft., June 25, 1892, *Duthie 11468* (DD); below Baltal, Sind Valley, 9–10000 ft., June 26, 1892, *Duthie 11566* (DD); Gudhai Valley, Astor Dist., 12–13000 ft., July 21, 1892, *Duthie* (DD); Kinimola nala, Liddar Valley, May 23, 1901, *Inayat* (UC).

4A. **Onosma hispidum** var. **kashmiricum**, comb. nov.

Onosma kashmirica Johnston, Jour. Arnold Arb. **21**: 50 (1940).—Type from Pan Dras, Ladak Road, Kashmir, *R. R. Stewart 10053*.

Corolla longer and proportionately more elongate than in the type form, about three times longer than broad, 28–30 mm. long; filaments longer (7–9 mm.) and affixed higher on the corolla (12–13 mm. above base).

KASHMIR: Pan Dras, Ladak Road, 10000 ft., *R. R. Stewart 10053* (G, TYPE); Tashgam, Treaty Road, Ladak, stony hillslope, fl. cream, *Ludlow & Sherriff 8340* (G); Shumkergadh, Kaminala, Astor Valley, *Inayat 25702* (DD); without locality, *herb. Falconer* (G); without locality, 5–8000 ft., *T. Thomson* (G).

This species appears to be the most common and widely distributed *Onosma* in the western Himalayas. Certainly it has been collected more frequently than any other species in our area. Though in the past usually identified with *O. echioides* L. it is not at all closely related to that species of Europe. Among the Indian species only *O. dichroanthum* has any particular relations with the latter. The immediate relations of *O. hispidum* are with *O. Gmelini* Ledb. of the Altai.

Onosma hispidum has a distinctive habit and is usually recognizable at a glance. In its area its strong root, clustered coarse stems, persisting elongate basal leaves and slightly tawny very bristly indument are distinctive. Except in parts of Kashmir, another distinctive feature is its short stout corollas, generally about twice as long as broad. A form of the species in Kashmir, however, has longer and proportionately more elongate corollas, generally about three times longer than broad. It has been distinguished as the var. *kashmiricum*. It comes from an area in which the typical form of the species has been found and differs from it only in corollas. It merits recognition only because of the uniformity of the species elsewhere over its wide area of distribution.

5. **Onosma khyberianum,** sp. nov.

Planta ut videtur perennis hispidissima et minute hispidula pilis conspicuis pallidis 1.5–4 mm. longis et pilulis inconspicuis 0.05–0.1 mm. longis obsita; caulibus pluribus erectis adscendentibusve 15–25 cm. longis basim versus 3–4 mm. crassis simplicibus; foliis firmis enervatis, in facie superiore basibus pilorum discoideis pallidis praeditis; foliis basalibus 4–9 cm. longis 5–9 mm. latis anguste oblanceolatis acutis obtusisve tempore florendi persistentibus; foliis caulinis superioribus ca. 4 cm. longis 5–6 mm. latis acutis; cymis solitariis terminalibus simplicibus vel rare furcatis, sub anthesi cernuis ca. 5 cm. diametro; bracteis lanceolatis ad 2.5 cm. longis et 6 mm. latis apice longe attenuatis; calyce ad anthesin 18–23 mm. longo 2–4 mm. longe pedicellato, lobis 15–20 mm. longis anguste lanceolatis apice attenuatis; corolla alba vel ochroleuca, 30–32 mm. longa, a basi 2–3 mm. crassa sursum gradatim ampliata, apicem versus 8–10 mm. crassa, extus lobis deltoideis 2.5–3 mm. latis longisque pilulis sparsis donata alibi glabra; antheris 11–13 mm. longis basaliter lateraliterque cohaerentibus tubum formantibus, 3–4 mm. supra basim affixis, basibus 5–8 mm. infra sinus corollae positis, apicibus sterilibus 1.5–2 mm. longis exsertis, connectivo tumido muriculato; filamentis 9–10 mm. longis, ligulatis, basim versus ampliatis, 13–15 mm. supra basim corollae orientibus, basi 5–6 mm. longe decurrentibus; nectario glabro lobulato 0.2–0.4 mm. alto; nuculis ad 3 mm. longis, nitidis, laevibus.

INDIA (Northwest Frontier): Khyber Pass, rocky mountains, 3700 ft.

alt., stems ascending, fl. drooping, corolla white, April 9, 1899, *H. H. Johnston 22* (TYPE, Edinburgh); Landi Kotal, rocky hillsides, 3600 ft., leaves grayish intensely bristly, fl. creamy white fading to yellow, March 30, 1942, *D. L. 709* (Ed).

Distinctive of the species are its slenderly attenuate bracts, very elongate corollas, and large handsome nodding cymes; all characters readily separating it from its closest relative, *O. Griffithii.* The two specimens cited are both from Khyber Pass. Possibly it may occur also in Chitral. An incomplete specimen at Dehra Dun (*Gatacre 17343* from 7000 ft. in Baraul Valley) possibly is conspecific. It differs from the type form in having acute, rather than attenuate bracts, as well as in its somewhat tawny, rather than pale, indument.

6. **Onosma barbigerum,** sp. nov.

Planta ut videtur biennis hispidissima et minute hispidula pilis conspicuis gracilibus pungentibus 3–5 mm. longis cinereis et pilulis inconspicuis patentibus abundantibus 0.05–0.1 mm. longis donata; caulibus pluribus, erectis vel adscendentibus, simplicibus, 1.5–4 dm. longis, basim versus 4–7 mm. crassis; foliis viridibus, hispidis, haud vel vix nervatis, in facie superiore basis pallidis discoideis pilorum notatis; foliis basalibus oblanceolatis, 8–16 cm. longis, 8–17 mm. latis, apice acutis obtusisve; foliis caulinis medionalis oblongis vel elliptico-oblongis, 3–5 cm. longis, 8–14 mm. latis; cymis terminalibus, simplicibus vel furcatis, sub anthesi 4–6 cm. latis, maturitate elongatis racemosis 8–12 cm. longis; bracteis lanceolatis; calyce sub anthesi 15–20 mm. longo 1–3 mm. longe pedicellato, maturitate 18–23 mm. longo, 2–6 mm. longe pedicellato, lobis linearibus vel lineari-lanceolatis; corolla 22–25 mm. longis, a basi 2–3 mm. crassa sursum gradatim ampliata, infra sinus 7–9 mm. crassa, extus lobis deltoideis 2.5–3 mm. latis longisque pilulis sparsis donata alibi glabra; antheris basaliter lateraliterque cohaerentibus, tubum formantibus, 9–12 mm. longis, 2.5–3.5 mm. supra basim affixis, basibus 6–9 mm. infra fundum sinuum corollae positis, apicibus sterilibus 1–2 mm. longis saepe exsertis, connectivo tumido muriculato; filamentis 6–8(–9) mm. longis, ligulatis, basim versus plus minusve ampliatis, 10–13 mm. supra basim corollae orientibus, basi 5–7 mm. longe decurrentibus; nectario anguste glabro lobulato ad 0.4 mm. alto.

BALUCHISTAN: Quetta, 1888, *Duthie 8682* (TYPE, Dehra Dun); Hanna, 7000 ft., 1888, *Lace 3776* (DD); Moorga to Hindubagh, 5500 ft., May 5, 1895,—no. *18925* (DD); without loc., 1891–4, *C. F. Elliott* (DD); without loc., *Sticks 1137* (DD).

AFGHANISTAN: without loc., *Griffith 5947* (G).

A coarse, very bristly herb notable among its close relatives for its relatively broad green leaves.

7. **Onosma Griffithii** Vatke, Zeits. Gesammten Naturwiss. (Berlin) 45: 127 (1875).—Type from "Afghanistan," *Griffith 5947.*

Plant apparently perennial, cinereous, bristly with stiff slender hairs 2–3 or sometimes 5 mm. long, also minutely hispidulous with hairs 0.05–

0.1 mm. long; stems several, 1–3 dm. tall, simple or occasionally with short floriferous branchlets near the apex, 2–5 mm. thick towards the base; leaves firm, rarely with visible veins, upper surface with the bristles frequently antrorsely appressed; basal leaves linear-oblanceolate, 6–10 cm. long, 4–12 mm. broad, obtuse; middle cauline leaves linear, 3–5 cm. long, 3–7 mm. broad, acute or obtuse; cymes terminal, simple or sometimes forked, at anthesis 3–4 cm. broad; bracts lanceolate; calyx at anthesis 15–20 mm. long, lobes subulate-linear, 1–1.5 mm. broad, pedicel 1–3 mm. long; mature calyx 18–23 mm. long, lobes 2–3 mm. broad, pedicles 5–10 mm. long; corolla 27–30 mm. long, from a base 2.5–3 mm. thick gradually ampliate, becoming 7–8 mm. thick below the sinus, entirely glabrous or with a few hairs on the outside of the lobes; anthers 11–12 mm. long, united into a tube, affixed 3.5–4 mm. above base, base held 7–8 mm. below level of corolla-sinus; connective thickened, muriculate; filaments 8–9 mm. long, ligulate, arising 12–15 mm. above base of corolla, decurrent base 4–7 mm.; nectary narrow, lobulate, less than 0.5 mm. high, glabrous.

INDIA: Razani, Waziristan, 8000 ft., fl. white, Apr. 1924, *A. G. Lester-Garland* (K); Waziristan, *Harsukh 15805* (DD); Lekesur, Salt Range, Punjab, March 22, 1881, *Fleming* (Ed); Bundai, Chitral, *Harriss 16404* (DD).

AFGHANISTAN: without loc., *Griffith 5947* (DD, TYPE number).

What is here called *Onosma Griffithii* is an extremely unsatisfactory concept. It includes plants showing evident relations with *O. khyberianum* as well as with *O. barbigerum* and possibly is an aggregate. Furthermore, the name applied to it is one associated with much doubt.

The proper classification and the precise relations of the plants here referred to *O. Griffithii* can be established only after the study and analysis of a larger series of better specimens from western India than has been available to me. *Onosma Griffithii* Vatke was published in a journal not readily available to most botanists and was described as follows: "Onosma (Euonosma) Griffithii Vatke. totum setis longis albis patulis e tuberculo glabro ortis dense vestitum, caulibus e rhizomate pluribus adscendentibus diffusis simplicibus, foliis basalibus oblongo-lanceolatis basi petiolatim angustatis, caulinis sessilibus, superioribus ovato-lanceolatis, omnibus obtusiusculis, spicis brevibus plurifloris, calycis albo-setosissimi laciniis lanceolatis, corollae glabrae calyce parum longioris lobis brevibus obtusis reflexis, antheris filamento subtriplo longioribus ad medium fere exsertis. In Affghanistan coll. Griffith! n. 5947 ex distrib. kew. 1863-4 (n. 5946 ejusdem coll. ex. sp. nimis incompleto determinare nequeo.) Planta alt. fere 2 dm.; folia inferiora ad 7 cm. longa, ad 1 cm. lata subtus costa margineque praecipue setosa; corollae tubus c. 2 cm. longus."

The diagnosis is ambiguous and, I suspect, probably hastily and carelessly prepared. *Griffith 5946* is the type-collection of *O. limitaneum* var. *majus* Johnston. Unhappily there is some doubt as to the identity of the plant available to Vatke as *Griffith 5947*. This type, formerly at Berlin, was a casualty in the recent war. The number appears to be associated

with a mixture of closely related species. Stroh, Beih. Bot. Centralbl. 59[B]: 433 and 435 (1939), cites *O. Griffithii* in the synonymy of both *O. setosum dichroanthum* and *O. stenosiphon*. A duplicate at the Gray Herbarium (though imperfect) appears to represent *O. barbigerum*. Another at Dehra Dun I am accepting as representative of *O. Griffithii*, since it agrees better with the description of the species. Vatke's description, however, calls for a plant with a rhizome, a corolla 2 cm. long, and anthers exserted to the middle and about three times as long as the filaments. These are developments very different from those found in either of the duplicates of *Griffith 5947* available to me. Since I doubt the accuracy of Vatke's diagnosis I have ignored the discrepancies noted.

8. **Onosma Waltoni** Duthie, Kew Bull. 1912: 41 (1912). — Type material from Gyantze, Tibet, *Walton 60, 1560* and *1562*.

Plant "perennial, suffrutescent at base," stems becoming at least 3 dm. long and 2.5 mm. thick, hispid (hairs 1–2 mm. long, straight, spreading, bulbose-based, moderately numerous) and also retrorsely appressed hispidulous (hairs abundant, 0.1–0.3 mm. long); leaves "2–4 cm. long, 6–8 mm. broad," firm, veinless, upper surface hispid and hispidulous (the hairs loosely appressed and all bulbose based), lower surface sparingly bristly; basal leaves not seen; cauline leaves oblanceolate, 2–4 cm. long, 4–6 mm. broad, obtuse base broadened and semi-amplexicaul; cymes solitary, terminal on main stems and on slender peduncles 1–3 cm. long arising from many leaf-axils, at anthesis dense, 1–2 cm. broad; calyx at anthesis 6–7 mm. long, appressed white villose inside, outside pungently bristly, pedicel 1–3 mm. long, in fruit almost 9 mm. long with pedicels up to 8 mm. long; corolla 14 (fide Duthie 10–30) mm. long, from a base 1.5–2 mm. thick gradually expanded, becoming 6–7 mm. thick just below the sinus, texture unusually thin, densely but very minutely and inconspicuously puberulent, evidently hairy only on the nectary and outside near tip of lobes; corolla-lobes triangular, 2 mm. broad, 1.5 mm. long; anthers 7 mm. long, coherent basally and laterally to form a tube, affixed 2–2.5 mm. above base, base borne ca. 5.5 mm. below level of corolla-sinus; filaments very slender, 3–3.3 mm. long, arising 6.5–7 mm. above corolla-base, very minutely and inconspicuously puberulent, decurrent base about 3 mm. long, linear, puberulent, marked by a slight intrusion on outer surface of corolla; nectary villose, membranous, ca. 0.2 mm. high, apparently lobulate; style 15 mm. long, glabrous; nutlets 2.5–3 mm. long, lustrous, white, obscurely "tuberculate" or rugose.

TIBET: Gyangtse, 1904, *Walton s. n.* sub *O. Waddellii* (Ed).

My account of this species is based upon the unnumbered collection made by Walton cited above. Though labeled "*Onosma Waddellii* Duthie, n. sp.," it agrees reasonably well with the original description of *O. Waltoni* and was collected at the same locality and by the same collector as the numbered syntypes of that species. It differs from the original description in having corollas 14 mm., rather than 10–30 mm. long, and in having

the filaments arising at or near the middle of the corolla and not, as Duthie infers, distinctly below the middle. The species described is a well-marked one and is perhaps most closely related to *O. Waddellii*. From that species it differs in having a more elongate, more cylindrical corolla which not only has a thinner texture, but is also more abundantly puberulent on the outer surface. Its filaments are borne near the middle of the corolla, not below, and are decidedly puberulent. The decurrent base of the filaments is linear, more elongate, and decidedly puberulent, not lanceolate nor tumid. The stem-leaves are more broadly sessile. The puberulence on the corolla of *O. Waltoni* is very distinctive. It is composed of abundant, very minute, short thickish hairs, and at times appears somewhat farinose.

9. **Onosma Wardii** (W. W. Sm.), comb. nov.

Onosma Hookeri var. *Wardii* W. W. Smith, Notes R. Bot. Gard. Edinburgh **9:** 113 (1916).—Type from Ka-gwr-pw [Ka-kar-po] mountain, northwestern Yunnan, *Ward s. n.*

Plant perennial, arising from a dye-stained taproot, indument slenderly hispid (hairs 1.5–5 mm. long, ascending) and villulose (hairs pale, 0.2–0.3 mm. long); stems ascending or decumbent, several, 3–6 dm. long, usually simple, 3–5 mm. thick towards base, hispid and retrorsely villulose; leaves with upper surface green, with appressed bristles 1.5–3 mm. long, arising from discoid bases, lower surface pale, abundantly villulose and hence somewhat velvety, coarse hairs few; basal leaves persisting at anthesis, oblanceolate, 10–18 cm. long, 1–2 cm. broad, acute; middle cauline leaves lanceolate or oblong-lanceolate, acute, 5–9 cm. long, 6–12 mm. broad, base acute to rounded; cymes simple, terminal on the main stem and on short peduncles in the uppermost axils, at anthesis 3–5 cm. broad; calyx 12–17 mm. long, villose, pedicels 5–15 mm. long; corolla "purplish blue," 20 mm. long, antrorsely strigose outside, inside appressed villose along a line below each corolla-lobe, except for the villose nectary otherwise glabrous, from a base 2 mm. thick gradually expanding and becoming 8–11 mm. broad at the level of the sinus; anthers 10 mm. long, joined basally and laterally to form a tube, affixed 2–3 mm. above base, sterile apex ca. 2 mm. long, base carried 9 mm. below level of corolla-sinus; filaments 6.5 mm. long, arising 6.5 mm. above corolla-base, decurrent base 2–3 mm. long; nectary 0.2 mm. high, lobed, villose; nutlets not seen.

CHINA (Northwest Yunnan): Temple, Ka-gwr-pw, Mekong-Salween divide about lat. 28°30′, 13000 ft., July 26, 1913, *Ward 902* (Ed, TYPE; G, ISOTYPE); specimen grown in England from seed collected by Ward, sub no. 902, 1914, *Bees Ltd.* (Ed).

This plant from near the Tibetan border in northwestern Yunnan in gross habit very much resembles *O. Hookeri* var. *intermedium* of southeastern Tibet. By coincidence the two plants were given confusingly similar names when they were originally described. Our plant was called *O. Hookeri* var. *Wardii* W. W. Sm. (1916) and that from Tibet *O. Hookeri* subsp. *Wardii* Stapf (1931). These two plants, however, differ in many

respects and are obviously different species. In our plant, *O. Wardii*, the corolla is strigose outside and has a vertical line of hairs below each lobe on the inside of the throat. Its anthers are united into a tube and its filaments arise below the middle of the corolla. In the Tibetan plant (now called *O. Hookeri* var. *intermedium*) the larger corolla is villose-strigose outside and glabrous on the throat inside. Its anthers are united at the base only and its filaments arise midway up the corolla. The decurrent bases of its filaments are narrow, thickish, and very prolonged. Despite their superficial resemblances, the two plants are probably not closely related. *Onosma Wardii* probably has its closest affinities with the habitally dissimilar *O. confertum*.

10. **Onosma confertum** W. W. Smith, Notes. R. Bot. Garden Edinburgh 8: 106 (1913). — Type from mountains enclosing Lang Kong River, Yunnan, *Forrest 6436*.

Onosma Forrestii W. W. Smith, Notes R. Bot. Garden Edinburgh 8: 107 (1913) — based on garden plants grown from seeds collected in Yunnan by Forrest in 1910.

Plant arising from a coarse dye-stained taproot; stems usually single from the basal leaf-cluster, erect, 3–10 dm. tall, 3–9 mm. thick towards the base, sparingly hispid (hairs 1–3 mm. long, spreading or ascending, with a thickened base) and villulose-hispidulous (hairs 0.1–0.3 mm. long, appressed, mostly antrorse but tending to be retrorse below middle); leaves veinless, upper surface green, appressed or spreading hispid the hairs usually with discoid bases, lower surface sparingly hispid, usually pallid from an abundance of minute pale hairs; basal leaves usually dried at flowering time, oblanceolate, acute, 10–15 cm. long, 9–18 mm. broad; middle cauline leaves lanceolate, 4–12 cm. long, 5–15 mm. broad; cymes numerous, simple or forked, at anthesis 2–4 mm. broad, terminal on the stem and on slender peduncles 3–10 cm. long from the axils above the middle of the plant, hence in an elongate open paniculate arrangement; calyx 9–12 mm. long, pedicels slender, 6–12 mm. long; corolla pink, red, or purple, 13–18 mm. long, from a base 1.5–2 mm. thick gradually expanded and becoming 7–11 mm. thick at the level of the sinus, evidently strigose outside, inside with hairy nectary and frequently with a line of hairs below each corolla-lobe but otherwise glabrous; anthers 6.5–8.5 mm. long, coherent basally and laterally to form a tube, affixed 1–1.5 mm. above base, base borne generally 6–7 mm. below level of corolla-sinus; filaments 5–8 mm. long, arising 3–4 mm. above corolla-base, decurrent base 2–2.5 mm. long, generally broadened and thickened downward towards the abruptly rounded lower end; nectary represented by five villose lobules; style glabrous 16–18 mm. long; nutlets 2.5–3 mm. long, brownish, angular, more or less warted.

Known from middle northern Yunnan and northward into western Sikang.

YUNNAN: mountains enclosing Lang Kong River, lat. 26°10′, dry arid situations, plant 2–3.5 ft. tall, 8000–9000 ft., fl. soft rose, *Forrest 6436* (Ed,

TYPE of *O. confertum;* G, UC, ISOTYPES); mountains forming Lang Kong gorge, southern boundary of Lang Kong Valley, lat. 26°10′, 8000 ft., plant 1–2 ft. tall, exceedingly dry rocky slope, fl. bright blue, *Forrest 5991* (Ed); Ahsi, northwest Likiang Snow Range on Yangtze, open ledges, plant 3 ft., fl. dull rose-purple, *R. C. Ching 20786* (G); Yülun-schau near Likiang, *Handel-Mazzetti 7009* (G); inter Lanticho et Poloti, reg. Yungning-Yungpeh, ad l. m., fl. obscure purp., 2500 m., *Schneider 1682* (G, Ed); Mt. Wuaha, Tungning Terr., pine forest, 10000 ft., fl. purplish red, *Rock 24234* (NY, Ed); Chungtien, *T. T. Yü 12496* (G); western Yunnan, *Forrest 28822* (G).

SIKANG: above Litang river, 9000 ft., shaded limestone cliff, *Ward 4263* (G, Ed); Muli, Ku-lu, Hai-yeh-tze, 3100 ft., *T. T. Yü 14323* (G); Muli, Gu-tu, 2200–2300 ft., *T. T. Yü 14211* (G).

WITHOUT LOCALITY: garden plant, grown from seeds collected by Forrest, flowered by Bees Limited in July 1912, *herb. Edinburgh* (Ed, TYPE of *O. Forrestii*).

A well-marked species to be confused only with *O. album.* The latter differs, however, in flower-color, extruded stamens, hairy style, and unthickened decurrent base of the filaments. In gross habit the two species are remarkably similar. When young these species have the habit of a biennial. The taproot develops a leaf-rosette the first season and the following season a single erect stem bearing paniculately disposed cymes. With biennials such as *O. paniculatum* the root dies after the fruiting season. Our present plant, about the base of its fruiting stem, forms short stout offsets which produce new leaf-clusters and eventually additional flowering stems

The type of *O. Forrestii* is an abnormal plant grown in the British Isles from seed collected by Forrest during 1910, very likely along the Lang Kong River in northern Yunnan, where the type specimen of *O. confertum* originated also. The peculiarities of *O. Forrestii* probably resulted from growth in an unfavorable environment. In technical characters it agrees with *O. confertum* satisfactorily.

11. **Onosma sinicum** Diels, Bot. Jahrb. 29: 546 (1901). — Type from "Wen-chuan, Ta-chi-kou," Szechuan, *Rosthorn 3011.*

A suffruticose perennial; root woody; stem slender, 1–4.5 mm. thick; old stems loosely branched, sprawling or decumbent, 1–3 dm. long, producing numerous axillary leaf-fascicles or leafy floriferous branchlets, old parts leafless and decorticating; branchlets erect or ascending, slender, 5–15 cm. long, very leafy, hispid (hairs 1–2 mm. long, with a thickened base, spreading or ascending) and also hispidulous (hairs 0.1–0.4 mm. long, slender, erect or ascending); leaves all cauline, veinless, oblanceolate, 0.7–5 cm. long, 1.5–9 mm. broad, acute or obtusish, broadest at or above middle and gradually contracting to a very narrow or even subpetiolate base (or uppermost leaves lanceolate or even elliptic), upper surface usually appressed hispid (hairs ca. 1 mm. long, with discoid bases) and also minutely hispidulous, lower surface paler, abundantly hispidulous; cymes small, simple or rarely forked, at anthesis 1.5–2 cm. broad, in age uni-

laterally racemose and 5–10 cm. long, terminal on the leafy branchlets or borne on slender peduncles 1–2 cm. long arising from the uppermost leaf-axils; bracts small, lanceolate or ovate-lanceolate, 1–4 mm. long; calyx 7–9 mm. long, strigose to hispid-villose; lobes linear to lance-linear, 0.5–1 mm. broad; pedicel slender, at anthesis 1–3 mm. long, becoming 3–8 mm. long in fruit; corolla blue, 8.5–9.5 mm. long, from a base 2–2.5 mm. thick at first gradually then more abruptly expanded, becoming 4–6 mm. thick below level of sinus, outside antrorsely puberulent and sparsely strigulose; anthers 5.5–6.6 mm. long, united on base and sides to form a tube, conspicuously exserted, affixed 1–1.5 mm. above base, sterile tip very short about 0.5 mm. long, base carried 0–2 mm. below level of corolla-sinus; filaments 5–7 mm. long, slender, slightly thickened above the non-decurrent attachment, arising 2.5–3 mm. above corolla-base, conspicuously villose at the base; nectary consisting of 5–10 lobules 0.1–0.2 mm. long, densely villose; style 10–16 mm. long, glabrous; nutlets 2–2.5 mm. long, gray, dull, verrucose.

CHINA (Szechwan): Pehchuan Hsien, Sihchuan, on rocks, herb 5–8 inches tall, fl. blue, *W. P. Fang 5608* (G, Ed); Mo Hsien, Mowchow, roadside herb 1–2 ft. tall, fl. blue, *W. P. Fang 1503* (G, Ed); descending to Mao-kung Hsien, rocky place at roadside, 3000–3200 m., fl. blue, some red, *F. T. Wang 21298* (G).

This species is known only from northwestern Szechuan. The type was collected along the Min River about 100 km. northwest of Chengtu. The closest relative of the plant appears to be *O. Farrerii,* which ranges just north of it in southern Kansu. Both species have similar suffruticose habit and both have similar oblanceolate leaves contracted to a very narrow base. The flowers of the two species, however, are very different. In *O. Farrerii,* except for the sparingly hairy nectary, the corolla is glabrous inside. Its larger anthers have elongate sterile tips and its glabrous filaments have a broader base.

12. **Onosma burmanicum** Collett & Hemsley, Jour. Linn. Soc. London, Bot. 28: 93 (1891). — Type from Shan Hills, Burma, at 4000 ft., "once met with, growing gergariously on a grassy hill-side on road from Koni to Fort Stedman, by way of the Inleywa Lake," *Collett 941.*

Plant becoming at least 1 m. tall and possibly shrubby; stems elongate, unbranched, erect, 5 mm. thick towards the base, somewhat woody, apparently vegetative during several years, producing a very crowded mass of foliage (internodes ca. 1 mm. long) and lengthening only 0.5–1.5 dm. each season, during the final season lengthening at least 4–5 dm. (internodes as much as 20 mm. long) and terminating in the inflorescence; leaves on sterile stems 6–11 cm. long, from the sessile base 2–5 mm. broad very gradually narrowed towards the apex, linear-cuneate, extremely numerous and crowded, ascending or spreading, in age deflexed, dead ones persisting and clothing the older portions of the stem, margins usually strongly revolute and more or less obscuring the lower surface, upper surface green scabrous hispid (hairs slender, 1 mm. long, with a pallid bulbose base),

lower surface usually pallid from an abundance of slender appressed silky hairs; leaves on elongate floriferous shoot lanceolate to cuneate, 3–4 cm. long, 3–6 mm. broad, sessile, narrowly revolute, upper surface with appressed hairs lacking bulbose bases, lower surface smooth, white, silky strigose; inflorescence loosely paniculate, composed of numerous cymes borne on bracteate peduncles (1–5 cm. long) springing from the axils along the upper 1–2 dm. of the main stem, 10–15 cm. broad, 10–30 cm. long; cymes small, at anthesis 1–2 cm. broad, at maturity straightening and lengthening, becoming about 5 cm. long; calyx 8–10 mm. long, lobes 0.5–1 mm. broad, linear; pedicels 3–5 mm. long at anthesis, later as much as 10 mm. long; corolla 10.5–13 mm. long, with a short subcylindric tube 2–2.5 mm. broad and 2.5–3 mm. long, then with a gradually ampliate throat becoming 5–7 mm. in diameter at the level of the sinus, with tight inflexed vertical pleats below each sinus, outside abundantly antrorse strigose above the middle, inside conspicuous villulose in a band 2–4 mm. above the base, except for the villulose nectary otherwise glabrous; anthers 7–10 mm. long, united into a tube, conspicuously exserted, affixed 1.5–2.5 mm. above base, sterile tip 2–2.5 mm. long, base carried 1.5–2.5 mm. below level of corolla-sinus; filaments 5.5–7.5 mm. long, very slender, hairy towards base, not decurrent, arising 2.5 mm. above corolla-base; nectary very narrow, lobed, villose, ca. 0.1–0.2 mm. high; style 11–17 mm. long, glabrous; nutlets 3–3.5 mm. long, dull, brownish, verrucose.

BURMA: Fort Stedman, Upper Burma, lat. 20°30′, Dec. 1892, *Abul Hak* (DD); Shan Hills, Koni dist., 4000 ft., Nov. 12, 1888, *H. Collett 941* (K, TYPE); Gawle Reserve, Thaungyun Div. (ca. lat. 16°30′), hilly ground, fl. brown, Sept. 20, 1924, *Burman Collector* (DD, G).

A very distinct species, remarkable in a number of respects. It is the most southerly ranging species in the entire genus. Its habit of growth is unlike that of other congeners. Unhappily collectors have not provided information concerning the appearance and behavior of the living plant. From what can be deduced from the specimens available, it is probably shrubby, and very likely becomes more than a meter tall. Its growth-habit may suggest that of some of the smaller shrubby species of *Echium* known from the Canary Islands. Certainly no other member of *Onosma* develops simple erect shrubby stems which annually produce a dense new terminal leaf-cluster after a yearly growth of only 5–10 cm. until finally, after slow growth and vegetating for as much as five years, they terminate in a final season by lengthening as much as 5 dm. and by producing flowers. The vegetative branches are about 5 mm. thick, have very short internodes, and bear their very slender elongate functional leaves in a brush-like terminal cluster above the skirt-like mass of dead persisting reflexed leaves from previous seasons.

The material I have examined comes from two areas separated by some 300 miles; one from the Shan Hills near Lake Inle, lat. 20° 30′, and the other from near the Siamese border, east of Moulmein, at about lat. 16°30′. Comparable parts from the two are very similar; indeed, the chief

difference appears to be in their pubescence. In the northern material the hairs along the stem and on upper leaf-face are tightly appressed, whereas in the southern material they are loosely appressed or ascending. The collection from the south is of great interest, since it includes sterile vegetative stems (described above) as well as the flowering shoot. The type from middle eastern Burma consists of the flowering shoot only.

13. **Onosma hypoleucum,** sp. nov.

Planta perennis fruticulosa pallida; caulibus foliosis, gracilibus, 3–5 dm. altis, basim versus 1–2.5 mm. crassis, pluribus, e basi lignosa orientibus, saepe erectis simplicibusque, sparse hispidis (pilis 1–1.5 mm. longis patentibus vel adpressis e basi pallida bulbosa orientibus) et abundanter albostrigulosis (pilulis 0.1–0.4 mm. longis antrorsis); foliis numerosissimis oblanceolatis vel lineari-lanceolatis 1.5–3 cm. longis 1.5–5 mm. latis enervatis firmis margine revolutis, in facie superiore cinereis basibus pallidis pilorum majorum notatis, in facie inferiore albis abundantissime sericeostrigulosis; cymis sub anthesi ca. 2 mm. latis, maturitate elongatis ad 10 cm. longis, terminalibus et e axillis supremis 1–3 cm. longe pedunculatis; calyce 10–13 mm. longo, lobis linearibus 0.5–1 mm. latis, pedicello gracili 1–10 mm. longo; corolla coerulea 10–11 mm. longa a basi 2 mm. crassa sursum ampliata sinus versus 4–5 mm. crassa extus minute abundanteque antrorso-strigosa, intus parte 1.5–2.5 mm. supra basim villosa, lobis 1–2.5 mm. latis 1–1.5 mm. longis margine revolutis; antheris 9–10 mm. longis in tubum cohaerentibus exsertis 1.5–2 mm. supra basim affixis, apicibus sterilibus 1–1.5 mm. longis, basibus ca. 2 mm. sub sinus corollae positis; filamentis 6–7 mm. longis 1.5–2 mm. supra basim corollae orientibus, a basi 0.3–0.5 mm. lata haud decurrenti sursum gradatim ampliatis ca. 0.5–1 mm. supra basim latissimis (0.5–0.7 mm. latis) deinde apicem versus gradatim attenuatis, parte 1–2 mm. longa infima villosis; nectario angusto lobato 0.1–0.3 mm. alto villoso; stylo 15 mm. longo glabro; nuculis 2.5–3 mm. longis nitidis pallidis obscure rugulosis.

Known only from the northwestern Himalaya, long. 73° to 76°30′.

INDIA: Changla Gali, Murree Hills, Punjab, 6500 ft., cliffs, fl. blue, Aug. 27, 1918, *R. R. Stewart 3956* (NY); Nagan, Muzaffarabad, range forest, Kishanganga Valley, Kashmir, 10000 ft., Sept. 1, 1907, — no. *1807* (DD); Chamba, 1896, *G. A. Gammie* (DD); Dharmsala, Kangra dist., Punjab, *Edgeworth* (DD); without loc., *J. L. Stewart 2239* (Ed); without loc., *Falconer* (TYPE, Gray Herb.).

It is surprising that this well-marked species has remained so long confused with *O. Thomsoni,* a habitally very similar plant also found in the front ranges of the northwestern Himalaya. The present plant does have more slender stems and smaller leaves beautifully silky strigose and white beneath, but the most marked differences from *O. Thomsoni* are those inside the corolla. The blue corollas of *O. hypoleucum* have a broader throat which outside is finely and evenly antrorse-strigose, not retrorsely strigose as in the white corollas of *O. Thomsoni.* This difference in pubescence is particularly well marked on the flower-buds. Inside the corolla is

evidently villose in a band 1.5–2.5 mm. above the base. Its filaments are hairy and perceptibly constricted just above their narrow attachment. In *O. Thomsoni* the filaments are glabrous and have a broad arcuate attachment and are not basally constricted. The two species are not even closely related.

14. **Onosma exsertum** Hemsley, in Hook. Icones Pl. **27**: t. 2639 (1900). — Type from grassy hills near Mengtze, Yunnan, *Henry 9334*.

Plant robust, 3–12 dm. tall, biennial; stem single, branched only in inflorescence, 5–10 mm. thick towards base, hispid (hairs 1–2 mm. long, few to many, ascending or closely and antrorsely appressed, base thickened) and also very minutely and inconspicuously hispidulous (hairs 0.1 mm. long); leaves somewhat coriaceous, veinless, upper surface green, strigose (hairs rigid, ca. 1 mm. long, with evident discoid bases), minute hairs scarce or none, lower surface with abundant minute hairs, ca. 0.1 mm. long and less abundantly and coarsely strigose; basal leaves developed the first year, oblanceolate, up to 30 cm. long and 7 cm. broad, obtusish; middle cauline leaves lanceolate or lance-oblong, acute 5–10 cm. long, 1.5–3 cm. broad; cymes numerous, relatively loose, 1–3 cm. broad at anthesis, terminal on the main stem and also on slender naked peduncles (3–10 cm. long) arising from the axils along the upper half of the main stem, hence displayed in a loosely paniculate arrangement; calyx 7–10 mm. long; lobes lanceolate, thickish, densely clad with short stout closely appressed thick-based hairs; pedicels 3–14 mm. long; corolla red then purple, 9–11.5 mm. long, with a subcylindric base 2 mm. thick and 3.5–4.5 mm. long and then expanding into a somewhat campanulate throat becoming 4.5–5 mm. thick, outside hispidulous or strigulose, usually retrorsely so, inside scantily strigulose along a vertical line below the lobes but otherwise glabrous; anthers 5.5–6.5 mm. long, united into a tube, usually completely exserted, affixed 1.5–2.5 mm. above base, sterile tips ad 1 mm. long, base carried at or above the level of the corolla-sinus; filaments 7.5–9.5 mm. long, subulate, glabrous, affixed 2.5–3.5 mm. above base of corolla, decurrent base 0.5–1 mm. long; nectary a very narrow glabrous collar 0.1–0.2 mm. high; style glabrous, 15–19 mm. long; nutlets ca. 3 mm. long, lustrous, pale, rugulose.

Southwestern China, in Yunnan and southern Sikang.

YUNNAN: Mengtze, *Henry 9334* (NY, US) and *9334B* (US); western flank of Tali Range, lat. 25°40′, 9000 ft., open stony pasture, plant 3 ft., fl. deep maroon, *Forrest 11586* (Ed); betw. Tsuyung and Gwangdung, ca. lat. 25°, *Handel-Mazzetti 4826* (G); Chungtien plateau, lat. 27°30′, open stony pasture, 9000 ft., *Forrest 12752* (Ed).

SIKANG: He-chang Hsien, mountain slope, open place, 1850 m., herb 2–4 ft. tall, fl. purplish blue, July 8, 1932, *T. T. Yü 1164* (G).

A very well marked species lacking any obviously close relative. It is notable for the coarse, short, closely appressed or even incurving hairs abundant on the inflorescence and especially on the pedicels and calyx, and frequently on the upper leaf-face also. Among the species with a

single very coarse tall stem it is readily recognized by the combination of completely exserted anthers and small corolla with rather well differentiated tube and throat.

15. **Onosma fistulosum,** sp. nov.

Planta robusta elata biennis; caulibus solitariis (fortasse supra medium ramulis floriferis gestis) fistulosis basim versus 8–14 mm. crassis hispidis (pilis 2–4 mm. longis patentibus retrorseve basi bulbosis); foliis in facie superiore viridibus scabris hispidulis (pilis abundantibus rigidiusculis patentibus 1–2 mm. longis basi pallida bulbosa orientibus), in facie inferiore nervatis hispidulis vel abundanter pallideque strigulosis et sparse hispidulis; foliis infimis ad 4 dm. longis et 4–6 cm. latis medium versus vel supra medium latioribus deinde apicem acuminatum versus gradatim contractis, basim versus in petiolum alatum ad 5–7 mm. latum et 10 cm. longum attenuatis; foliis caulinis medium versus latioribus utroque attenuatis, majoribus ad 2–2.5 dm. longis et 4–5 cm. latis; cymis fortasse numerosissimis in paniculatum amplam collectis sub anthesi 2–3 mm. latis; calyce 9–12 mm. longo basim versus hispido, lobis 1–1.7 mm. latis lanceo-linearibus; pedicello gracili 6–12 mm. longo; corolla 11–15 mm. longa a basi 2 mm. crassa primo leviter deinde validiore ampliata sinus versus 7–10 mm. crassa, extus supra medium sparse antrorseque strigulosa, intus (nectario excepto) glabra; lobis triangularibus 3–4 mm. latis 1.5–2 mm. longis margine revolutis; antheris 7–8 mm. longis in tubum cohaerentibus exsertis ad 2 mm. supra basim affixis, apicibus sterilibus 1.5–2 mm. longis, basibus 1–4 mm. infra sinus corollae positis; filamentis 7–9 mm. longis subulatis glabris 3–4 mm. supra basim corollae orientibus basi haud vel vix decurrentibus; nectario angusto 0.1–0.2 mm. alto lobato villoso; stylo 14–18 mm. longo glabro; nuculis ignotis.

CHINA: "Szechuan" [but probably within present-day Sikang], "en route," July 25, 1905, 5000 ft., fl. reddish, suffused purple, *E. H. Wilson 4165* (G); Wachin, Muli, Sikang, oak forest, 3000 ft., Sept. 1937, *T. T. Yü 14385* (TYPE, Gray Herb.).

A very well marked plant and probably the largest and most robust in the genus. It has a coarse single stem probably reaching 1–2 m. in height, and no doubt displays its cymes in a very large and ample panicle. The material available shows the stout biennial root and the base of the stem as well as some large basal leaves. Also available are sections of the coarse stem showing the leaves and one of the axillary floriferous branches produced by it. The coarse main stem, though becoming more than a centimeter thick, is hollow and pipe-like. The shell of conductive and support tissue surrounding the large central cavity is 1–3 mm. thick. In old stems it becomes hard and woody. The two collections studied have inadequate data. That from Yü was received with a collection-number but no field data. The locality I have given for it is that associated with other collections in the same gamut of numbers. Wilson's collection has no other data than that it was collected in Szechuan, "en route," on July 25

[? or 23], 1903. During the period of time indicated he was traveling in eastern Sikang. His collection is very similar in appearance to that of Yü.

16. **Onosma multiramosum** Handel-Mazzetti, Anzeiger Akad. Wiss. Wien 61: 166 (1924) and Symb. Sinicae 7²: 817 (1936). — Type from Yangtze about lat. 27° 45′, *Handel-Mazzetti 7596*.

Plant apparently perennial; stems erect or decumbent, 2–6 dm. long, becoming as much as 6 mm. thick towards the apparently persisting base, usually with numerous branchlets, hispid (hairs 1–4 mm. long, spreading, frequently pungent, base bulbose) and hispidulous (hairs abundant, 0.1–0.4 mm. long, retrorsely appressed) leaves usually veinless, numerous, all cauline, somewhat cinereous, hispid (hairs spreading, 1–2 mm. long, those on upper surface with bulbose base) and also abundantly hispidulous (hairs 0.1–0.2 mm. long, erect); lower leaves oblanceolate, 8–18 cm. long; middle leaves lanceolate to ovate-oblong, 3–6 cm. long, 5–15 mm. broad; cymes small, numerous, not forked, at anthesis 1–2 cm. broad, later elongating and becoming 5–12 cm. long, terminal on stem and branches and on peduncles 1–4 cm. long arising from the uppermost leaf-axils; calyx 6–9 mm. long, lobes slender, 0.5–1 mm. broad, pedicels 2–4 mm. long at anthesis later becoming 5–15 mm. long; corolla in the bud asymmetric, its tip strongly curving; corolla at anthesis white or violet, obscurely bilabiate, 8.5–10 mm. long, from a short subcylindric tube 1.5–2 mm. thick and 2–3 mm. long expanding into a throat becoming 3.5–5 mm. thick just below the sinus, outer surface antrorsely strigulose, inner surface with a vertical line of hairs below each lobe, throat infolded below each sinus and hence with 5 broad rounded ribs; lobes triangular, 2 mm. broad and 1.5 mm. long; anthers 7–9 mm. long, firmly united into a tube, with a prolonged curved tip, attached 1.5 mm. above base, sterile tip 2.5–3 mm. long, bases held 1–1.5 mm. below level of corolla-sinus; filaments subulate, glabrous, 5–6 mm. long, affixed 2.5–3.5 mm. above corolla-base, decurrent base as much as 1.5 mm. long; nectary narrow, lobed, 0.1–0.2 mm. high, villose; style 15–18 mm. long, glabrous; nutlets 3 mm. long, dull, tuberculate, pitted.

YUNNAN: mouth of Dou-tschu, valley of Yangtze [southwest of Chungtien], lat. 27°46′, 1650 m., fl. sordide violacei, *Handel-Mazzetti 7595* (Ed); Fengkou Valley, lat. 27°40′ [Yangtze bend], dry rocky place, 9000 ft., plant 1–2 ft., fl. white, *Forrest 12807* (Ed).

SIKANG: Mekong Gorge below Ya-ka-la, about lat. 29°, near Tibet-Yunnan borders, dry slate rocks in gorge, 9000 ft., fl. cream, anthers "state blue," 1922, *Ward 5362* in pt. (Ed).

16A. **Onosma multiramosum** var. **mekongense**, var. nov.

A varietate genuina differt faucibus corollae glabris; nectario sparse inconspicue villuloso.

YUNNAN: Mekong Valley [probably lat. 27°–29°], arid region, 8000 ft., 1913, *Ward 492* (TYPE, Edinburgh).

A most unusual feature of this plant is its clearly zygomorphic corollas. From the herbarium material available it has been impossible to determine

the orientation of the parts with complete certainty. It appears, however, that the adaxial side of the corolla is most prolonged. In the bud the distal third of the tightly folded corolla is decidedly bent or curved away from the axis of the cyme. On pendulous portions of the cyme this causes the bud-tips to be directed upwards. Later, however, when the cyme straightens, the curve or bend in the bud is downward. In open flowers borne on an erect axis it is the upper side of the corolla that is slightly but still very definitely more elongate than the lower. The zygomorphy of the corolla, however, is most obviously displayed in the anthers. These are well exserted and have their prolonged united sterile tips very noticeably decurved.

17. **Onosma adenopus,** sp. nov.

Planta perennis cinerea; caulibus solitariis vel pluribus e caudice laxo fruticoso orientibus 1–4 dm. longis, basim versus 2–3 mm. crassis, erectis vel adscendentibus, simplicibus vel apicem versus pedunculos axillares 1–3 cm. longos gracilis proferentibus, hispidis vel hispido-villosis (pilis 1–3 mm. longis, patentibus, basi inconspicue incrassatis) et strigulosis (pilulis 0.1–0.3 mm. longis retrorsis); foliis numerosis firmis enervatis, supra hispidis vel hispido-villosis (pilis adscendentibus 1–2 mm. longis basi discoidea orientibus) et villulosis (pilulis 0.1–0.3), subtus hispidis et villulosis; foliis basalibus oblanceolatis 1–4 cm. longis 2–6 mm. latis rosulatis; foliis caulinis medionalibus 1.5–4 cm. longis 2–12 mm. latis lanceolatis vel oblongis basi rotundis; cymis sub anthesi 1–2 cm. latis, maturitate elongatis 3–5 cm. longis; calyce 5–7 mm. longo, lobis gracilibus 0.5–1 mm. latis, pedicello 2–8 mm. longo; corolla violacea vel purpurea 8.5–9.5 mm. longa a basi 1.5 mm. crassa primo leviter deinde (1.5–2 mm. supra basim) validioriter ampliata, sub sinus 3.5–5 mm. crassa, supra medium infra sinus verticaliter plicata, extus praesertim in lobis antrorse minuteque strigulosis, intus supra medium secus nervos sparse strigosa; lobis 2–2.5 mm. longis 1.5 mm. latis erectis; antheris 6.5–7.5 mm. longis basaliter lateraliterque cohaerentibus exsertis tubum formantibus, 1–1.5 mm. supra basim affixis, apicibus sterilibus 2–3 mm. longis rectis, basibus ca. 2 mm. infra sinus corollae positis; filamentis 5–5.5 mm. longis subulatis e areola glandulifera minute papillata 1.5–2.5 mm. supra basim corollae orientibus, basim versus minute papillatis, basi haud decurrentibus; nectario ca. 0.1 mm. alto glaberrimo haud vel vix lobulato; stylo 9–17 mm. longo glabro; nuculis 2–3 mm. longis pallidis minute abundanterque papillatis et sparse tuberculatis.

CHINA (Sikang): Kon-ka-ling, Aug. 1937, *T. T. Yü 12909* (TYPE, Gray Herb.); Mekong Gorge, near Ya-ka-la, ca. lat. 29°, near Tibet-Yunnan border, young flowers pink, later turning bright violet, 1000 ft., *Ward 5363* (Ed); Dzer-nar, Tsa-wa-rung, 3200 m., oak bushes on dry sandy south exposure, fl. purple, 1935, *C. W. Wang 66520* (G); Shiangcheng, Sangbiling, 1937, *T. T. Yü 13370* (G).

A very well marked species probably most closely related to *O. multiramosum.* It is distinguished from all other congeners, at least in our area,

by having the base of the filament, as well as a small area on the corolla immediately surrounding it, glanduliferous and studded with papillae. The papillate areas on the corolla from which each filament arises are elliptic in outline and about 2 mm. broad. On the outside of the corolla their position is marked by a slight depression of similar size and shape. From *O. multiramosum* our species is also distinguished by having the less prolonged tip of the staminal tube straight rather than curved, as well as by having a completely glabrous rather than a villose nectary. Additional characters distinguishing it are found in its subsimple stems and in the more slender bristles on stems and leaves.

18. **Onosma album** W. W. Smith & J. F. Jeff. Notes R. Bot. Gard. Edinburgh 9: 112 (1916). — Type from Yung-pi Mts., Yunnan, *Forrest 11188*.

Plant 6 dm. tall, probably perennial; stem single, erect, 4–6 mm. thick towards base, bearing numerous pedunculate cymes from the axils above the middle, bristly (hairs 1–3 mm. long, spreading, with thickened base) and strigulose (hairs abundant, 0.1–0.3 mm. long, mostly retrorse); leaves veinless, above green, hispid, lower surface pale, densely strigulose and sparsely hispid; basal leaves mostly dried up at time of flowering, oblanceolate, 5–8 cm. long, 4–5 mm. broad, acute; middle stem-leaves lanceolate, 4–5 cm. long, 5–8 mm. broad, apex acute, base acute to rounded; cymes numerous, 1–4 cm. broad at anthesis, mostly simple, terminal on stem and on slender peducles 3–8 cm. long from upper axils, hence displayed in a loose elongate paniculate arrangement; calyx 10–13 mm. long, lobes lance-linear, pedicels slender, 5–20 mm. long; corolla pure white, 12.5–14 mm. long, from a base 2 mm. thick expanding and becoming 6–7 mm. broad just below the sinus, outside abundantly antrorse-strigulose, inside with hairs below the lobes and on nectary and decurrent base of filament; anthers 9.5–10 mm. long, coherent to form a tube, well exserted, affixed 2 mm. above base, sterile tips 2–3 mm. long, bases carried about 3 mm. below level of corolla-sinus; filaments 6–7 mm. long, arising 2.5–4 mm. above corolla-base, decurrent base 2–3 mm. long, bearing a few hairs towards its lower end; nectary very narrow, interrupted, villose, ca. 0.1 mm. high; style 14–20 mm. long, bearing some appressed hairs below the middle; nutlets not seen.

YUNNAN: on the Yung-pi Mts., lat. 26°45′, plant 2 ft., fl. pure white, open dry stony pasture, 10000 ft., Sept. 1913, *Forrest 11188* (Ed, TYPE).

A plant much resembling *O. confertum* in all save flowers. It differs in having a white corolla hairy in the throat, lobes less strongly recurved, anthers protruding, style hairy, and the decurrent base of the filaments unthickened.

(To be concluded)

STUDIES OF PACIFIC ISLAND PLANTS, IX
NOTES ON THE RUTACEAE OF FIJI, SAMOA, AND TONGA

A. C. SMITH

IDENTIFICATION OF THE SPECIMENS of Rutaceae recently obtained in Fiji by the writer[1] proved so difficult that a regional revision of the genera with dehiscent fruits seemed desirable. The species from Samoa, Tonga, and Niue are considered as well as those from Fiji. For the purposes of this study, the collections of the group in various herbaria have been examined, the place of deposit of specimens being indicated in this paper as follows: Arnold Arboretum (A); Bernice P. Bishop Museum (Bish); British Museum (BM); DePauw University (DP); Gray Herbarium (GH); Royal Botanic Gardens, Kew (K); New York Botanical Garden (NY); University of California (UC); and U. S. National Herbarium (US). I am much indebted to the authorities of these institutions for the privilege of examining specimens under their care.

The subfamily Aurantioideae is not considered in this treatment, since the indigenous species of this subfamily in our region are only two. *Micromelum minutum* (Forst. f.) Seem. is abundant throughout; it is a fairly variable species in indument, and Seemann takes it to include *M. glabrescens* Benth., described from Tonga. *Wenzelia kambarae* Swingle (in Jour. Arnold Arb. **21**: 12. 1940) is apparently limited to the Lau Group in Fiji. Otherwise, the subfamily is represented in our region only by the several species or varieties of *Citrus* which have become more or less naturalized; for a consideration of the Aurantioideae the reader is referred to W. T. Swingle's treatment in Webber, H. J., and L. D. Batchelor, The Citrus Industry **1**: 129–474. 1944.

The difficulties inherent in generic delimitation in the Rutaceae are well known, but most students are satisfied to follow Engler's treatment of the family (in Nat. Pfl. ed. 2. **19a**: 187–359. 1931). It may, indeed, be a very long time before that critical treatment is supplanted by anything in the nature of an improvement. Some problems relating to the *Evodia-Melicope-Acronychia* group of genera are briefly considered for Papuasia by Merrill and Perry (in Jour. Arnold Arb. **22**: 32–59. 1941). Specimens from Fiji and the adjacent archipelagos belonging to these three genera can usually be placed without difficulty if good material is available, but whether or not the currently accepted generic limits are natural can be decided only after exhaustive study by a monographer.

[1] Under the auspices of the Arnold Arboretum of Harvard University and the John Simon Guggenheim Memorial Foundation, with the aid of grants from the Penrose Fund of the American Philosophical Society and the Bache Fund of the National Academy of Sciences.

In the region under consideration there are now recognizable 23 species of dehiscent-fruited Rutaceae; of these I describe eight species and two varieties as new, while two new combinations are made. A greatly simplified key to the four genera concerned follows:

Leaves alternate, pinnate, with 2–8 pairs of lateral leaflets (in our species); stamens 4.....1. *Fagara.*
Leaves (in our species) prevailingly opposite, 1- or 3-foliolate.
Stamens 4; ovary deeply 4-lobed, the carpels essentially free in fruit.....2. *Evodia.*
Stamens 8 (in our species).
Ovary shallowly lobed, the lobes firmly connate even in fruit.....3. *Acronychia.*
Ovary with free carpels, these united in flower by the styles, divergent in fruit.....4. *Melicope.*

1. FAGARA L.

The species of this alliance in our region belong to *Fagara* rather than *Xanthoxylum,* following the interpretation of Engler (in Nat. Pfl. ed. 2. **19a**: 214–224. 1931). The confused generic nomenclature of these groups has been remarked by Reeder and Cheo (in Jour. Arnold Arb. **32**: 67. 1951), whose use of the names follows most current procedure. The species discussed below fall into Engler's section *Blackburnia.*

Individual plants of *Fagara* appear to be very rare in Fiji and Tonga and lacking in Samoa. Until 1936 the genus had not been recorded from Fiji, but at that time I noted the occurrence of two species (in Bishop Mus. Bull. **141**: 76–77, as *Zanthoxylum*). It now appears that four species of the group occur in Fiji, one of them extending into Tonga.

KEY TO THE SPECIES

Leaflets 2–5 pairs, the blades entire or essentially so, obviously inequilateral at base; flowers and fruits distinctly pedicellate.
Leaves usually 10–27 cm. long, the petiole (2–)3–5 cm. long; leaflet-blades chartaceous, more or less translucent when dried, the venation obvious on both surfaces, the margin nearly plane.....1. *F. pinnata.*
Leaves 8–13 cm. long, the petiole 1.5–3 cm. long; leaflet-blades coriaceous, opaque, with less obvious venation, strongly revolute at margin.....2. *F. gillespieana.*
Leaflets 6–8 pairs, the blades crenulate at margin, the indentations marked by glands, the base only slightly inequilateral; flowers sessile in ultimate clusters of 2 or 3.
Leaves 25–30 cm. long, the petiole (2–3 cm. long) and rachis obviously canaliculate; leaflet-blades 5–7 × 2–3 cm.....3. *F. vitiensis.*
Leaves 40–50 cm. long, the petiole (10–12 cm. long) and rachis subterete; leaflet-blades 11–15 × 4–5 cm.....4. *F. myriantha.*

1. **Fagara pinnata** (J. R. & G. Forst.) Engl. in Nat. Pfl. III. 4: 119. 1896, ed. 2. **19a**: 224. 1931.

Blackburnia pinnata J. R. & G. Forst. Char. Gen. *pl. 6.* 1776; Forst. f. Fl Ins. Austr. Prodr. 10. 1786.

Ptelea pinnata L. f. Suppl. 126. 1781.

Zanthoxylum blackburnia Benth. Fl. Austral. **1**: 363. 1863; Burkill in Jour. Linn. Soc. Bot. **35**: 30. 1901.

Zanthoxylum pinnatum Druce in Rep. Bot. Exch. Club Brit. Isles **1916**: 653. 1917; A. C. Sm. in Bishop Mus. Bull. **141**: 76. 1936.

DISTRIBUTION: Norfolk Island (type locality) to Fiji and Tonga; probably also in Australia, but the New Caledonian plants so referred may not belong here.

FIJI: FULANGA: In forest on limestone formation, alt. 0–80 m., *Smith 1150* (Bish, GH, K, NY, UC, US) (*warui;* tree 12 m. high; petals white; anthers yellow).

TONGA: *Harvey* (K). VAVAU: *Crosby* (K); Talau hill, alt. 120 m., *MacDaniels 1093* (Bish) (tree 12 m. high, the trunk 25 cm. in diameter).

It may be suspected that this entity has been too broadly interpreted. The Forsters' type (BM) from Norfolk Island was not re-examined in connection with the present study, but in 1936 I was apparently satisfied that the material from Tonga and Fiji agreed with the type. The range and variation of the Forsters' species should be studied by a monographer of the group.

2. **Fagara gillespieana** sp. nov.

Arbor ad 20 m. alta sub fructu ubique glabra, ramulis validis teretibus cinereis, foliis inflorescentiisque apices ramulorum versus congestis; foliis 8–13 cm. longis, petiolo 1.5–3 cm. longo subtereti vel semitereti basi incrassato, rhachi gracili leviter canaliculata; foliolis 2–4(raro 5-)-jugis oppositis, petiolulis gracilibus canaliculatis 4–8 mm. longis, laminis coriaceis opacis in sicco fusco-viridibus ovato-oblongis, plerumque 4–5.5 cm. longis et 2–3 cm. latis, basi inaequilateraliter obtusis, apice obtuse et breviter cuspidatis, margine integris anguste sed valde revolutis, supra subnitidis, costa supra impressa subtus prominente, nervis secundariis utrinsecus 6–8 supra paullo subtus manifeste elevatis, rete venularum utrinque subprominulo vel supra immerso; inflorescentiis sub anthesi non visis, sub fructu inter folia patentibus 5–9 cm. longis pauciramosis, pedunculo brevi et ramulis gracilibus subteretibus in sicco rugulosis, bracteis caducis, pedicellis subteretibus 2.5–6 mm. longis, calyce circiter 2 mm. diametro, lobis 4 persistentibus minutis deltoideis obtusis; fructibus ellipsoideis maturitate ad 14 mm. longis et 11 mm. latis, utroque rotundatis, pericarpio coriaceo valde ruguloso, semine ad 11 × 9 mm. nitido ut videtur nigro.

FIJI: VITI LEVU: Mba: Summit ridge of Mt. Nanggaranambuluta [Lomalangi], east of Nandarivatu, alt. about 1100 m., *Gillespie 3943* (Bish, GH, UC); Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, alt. 725–825 m., Aug. 7, 1947, *Smith 5578* (A TYPE, US) (*totowiwi;* tree 20 m. high, in dense forest).

Both cited specimens bear essentially mature fruits, but they seem indubitably closely allied to the preceding species, *F. pinnata.* The smaller, shorter petiolate leaves and the coriaceous leaflet-blades, which